Programming Flash Devices

Introduction

This document provides an overview of the various programming options available for the Actel Flash families. The electronic version of this document includes active links to all programming resources, which are available at http://www.actel.com/products/tools/prog.aspx. For Actel antifuse devices, refer to the *Programming Antifuse Devices* document.

General Flash Programming Information

Programming Basics

When choosing a programming solution, there are a number of options available. This section will provide a brief overview of those options. The next sections provide more detail on those options as they apply to Actel FPGAs.

Reprogrammable or One-Time-Programmable (OTP)

Depending on the technology chosen, devices may be reprogrammable or one-time-programmable (OTP). As the name implies, a reprogrammable device can be programmed many times. Generally, the contents of such a device will be completely overwritten when it is reprogrammed. All Actel Flash devices are reprogrammable.

An OTP device is programmable one time only. Once programmed, no more changes can be made to the contents. Actel Flash devices provide the option of disabling the reprogrammability for security purposes. This combines the convenience of reprogrammability during design verification with the security of an OTP technology for highly sensitive designs.

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Device Programmer or In-System Programming (ISP)

There are two fundamental ways to program an FPGA: using a device programmer or, if the technology permits, using in-system programming (ISP). A device programmer is a piece of equipment in a lab or on the production floor that is used for programming devices. The devices are placed into a socket mounted in a programming adapter module, and the appropriate electrical interface is applied. The device can then be placed on the board. A typical programmer, used during development, programs a single device at a time and is referred to as a single-site engineering programmer.

With ISP, the device is already mounted onto the board when programming occurs, most typically via the JTAG pins. The JTAG pins can be controlled by either an on-board resource, such as a microprocessor, or by an off-board programmer through a header connection. Once mounted, it can be programmed repeatedly. If the application requires it, the system can be designed to reprogram itself using a microprocessor, without the use of any external programmer.

For production, high-volume multi-site production programmers handle designs that require device programmers. In addition, Actel can preprogram devices for production, negating the need for further programming. This service is referred to as in-house programming (IHP).

Live at Power-Up (LAPU) or Boot PROM

Utilizing the technology of the FPGA significantly impacts board level power-up considerations. Some technologies are nonvolatile and are considered functional, or "live," as soon as power reaches the operational level. All Actel FPGA technologies are live at power-up. By contrast, SRAM technology is volatile, and devices built using SRAM cells lose their contents when power cycling occurs. These devices must be reprogrammed every time power is applied. This design must include nonvolatile storage for the contents as well as the means to reprogram. There is a delay before SRAM devices are functional; other parts of the board must come alive first in order to reprogram these types of FPGAs. Therefore, such devices can never be part of critical boot circuits.

Design Security

Design security is a growing concern for systems designers. The choice of programming methodology and technology will affect system security. Use of Actel programming technology is the most secure option available, providing much better protection than SRAM-based devices and ASICs. Actel provides a number of ways to ensure designs are protected. General information on design security can be found on the Actel website at http://www.actel.com/products/rescenter/security/index.html.

Programming Features for Actel Devices

Actel provides two types of FPGAs: Flash and antifuse (Table 1). Some programming methods are common to both and some are exclusive to Flash. This document describes only the programming solutions supported for Flash devices.

Table 1 • **Programming Features for Actel Devices**

Feature	Flash	Antifuse
Reprogrammable	Yes	No
In-system programmable	Yes	No
One-time programmable	Yes (option)	Yes
Live at power-up	Yes	Yes
Secure	Yes	Yes
Single-site programmer support	Yes	Yes
Multi-site programmer support	Yes	Yes
In-house programming support	Yes	Yes

Flash Devices

The Flash devices supplied by Actel are reprogrammable using either a generic device programmer or using ISP. Actel supports ISP using JTAG, which is supported by the FlashPro3, FlashPro, FlashPro Lite, and Sculptor programmers.

Since Flash devices are nonvolatile, they are live at power-up. This is different from an SRAM-based device, which loads its programming information when it is powered up. SRAM devices require a time in the order of hundreds of milliseconds before the system is active.

There are multiple levels of security available in Flash devices. Use of a security key will lock the device. The device can then only be reprogrammed by first unlocking the device with the appropriate security key. It can also be locked permanently, which means there is no key that can access the device. The command to secure the device is embedded within the programming file, optionally enabled by the programming software. This is also referred to as the OTP version of Flash, allowing for only a single programing instance. This is discussed in more detail in the *Implementation of Security in Actel's ProASIC and ProASIC^{PLUS} Flash-Based FPGAs* application note. For ProASIC3/E devices, refer to the *ProASIC3/E Security* application note.

Flash devices can also be programmed using single-site or multi-site programmers as well as volume-programming services from Actel or other vendors.

Types of Programming for Flash Devices

The number of devices to be programmed will influence the optimal programming methodology. Those available are listed below:

- In-system programming (ISP)
  - Using a programmer
  - Using a microprocessor or microcontroller
- Device programmers
  - Single-site programmers
  - Multi-site programmers, batch programmers, or gang programmers
  - Automated production (robotic) programmers
- Volume programming services
  - Actel in-house programming (IHP)
  - Programming centers

In-System Programming (ISP)

Device Type Supported: Flash

ISP refers to programming the FPGA after it has been mounted on the system board. The FPGA may be pre-programmed and later re-programmed using ISP.

The advantage of using ISP is the ability to upgrade the FPGA design many times without any changes to the board. This eliminates the requirement of using a socket for the FPGA, saving cost and improving reliability. It also reduces programming hardware expenses, as the ISP methodology is die package independent.

There are two methods of in-system programming: external and internal.

- Programmer ISP

  Using an external programmer and a cable, the device can be programmed through a header on the system board. In Actel documentation, this is referred to as external ISP. Actel provides FlashPro3, FlashPro Lite, FlashPro, or Silicon Sculptor II to perform external ISP. Note that Silicon Sculptor II can only provide ISP for ProASIC and ProASIC^{PLUS} families, not for ProASIC3 or ProASIC3E. It is too expensive a solution for ISP when compared with the FlashPro family.
  - Advantages: Allows local control of programming and data files for maximum security. The programming algorithms and hardware are available from Actel. The only hardware required on the board is a programming header.
  - Limitations: A negligible board space requirement for the programming header and JTAG signal routing.

- Microprocessor ISP

  Using a microprocessor and an external or internal memory, you can store the program in memory and use the microprocessor to perform the programming. In Actel documentation, this is referred to as internal ISP. Both the code for the programming algorithm and the FPGA programming file must be stored on memory on the board. Programming voltages must also be generated on the board.

  – Advantages: The programming code is stored in the system memory. An external programmer is not required during programming.
  – Limitations: This is the approach that requires the most design work, since some way of getting and/or storing the data is needed; a system interface to the device must be designed; and the low-level API interface to the programming firmware must be written and linked in to the code provided by Actel. While there are benefits to this methodology, serious thought and planning should go into the decision.

Device Programmers

Device Type Supported: Flash and Antifuse

Device programmers are used to program a device before it is mounted on the system board.

The advantage of using device programmers is that no programming hardware is required on the system board. Therefore, no additional components or board space are required.

If the devices will be programmed frequently with different programs, or if the number of devices to be programmed is relatively small, then a single-site device programmer is the simplest solution. For applications in which design security is paramount (often the case in military or space designs), the use of on-site programing maintains design security at all time.

Adapter modules are purchased with the programmers to support the FPGA packages used. The FPGA is placed in the adapter module and the programming software is run from a PC. Actel supplies the programming software for all of the Actel programmers. The software allows for the selection of the correct die/package and programming files. It will then program and verify the device.

- Single-site programmers

  A single-site programmer programs one device at a time. Actel offers Silicon Sculptor II as a single-site programmer.

  – Advantages: Lower cost than multi-site programmers. No additional overhead for programming on the system board. Allows local control of programming and data files for maximum security. Allows on-demand programming on-site.
  – Limitations: Only programs one device at a time.

- Multi-site programmers

  Often referred to as batch or gang programmers, multi-site programmers can program multiple devices at the same time using the same programming file. This is often used for large volume programming and by programming houses. The sites often have independent processors and memory enabling the sites to operate concurrently, meaning each site may start programming the same file independently. This enables the operator to change one device while the other sites continue programming, which increases throughput. Multiple adapter modules for the same package are required when using a multi-site programmer. Silicon Sculptor I and II programmers can be cascaded to program multiple devices in a chain. Multi-site programmers can also be purchased from BP Microsystems.

  – Advantages: Provides the capability of programming multiple devices at the same time. No additional overhead for programming on the system board. Allows local control of programming and data files for maximum security.
  – Limitations: More expensive than a single-site programmer.

- Automated Production (Robotic) Programmers

  Automated Production programmers are based on multi-site programmers. They consist of a large input tray holding multiple parts and a robotic arm to select and place parts into appropriate programming sockets automatically. When the programming of the parts is complete, the parts are removed and placed in a finished tray. The automated programmers are often used in volume programming houses to program parts for which the programming time is small.

Volume Programming Services

Device Type Supported: Flash and Antifuse

Once the design is stable for applications with large production volumes, preprogrammed devices can be purchased. Table 2 describes the volume programming services.

Advantages: As programming is outsourced, this solution is easier to implement than creating a substantial in-house programming capability. As programming houses specialize in large volume programming, this is often the most cost effective solution.

Limitations: There are some logistical issues with the use of a programming service provider, such as the transfer of programming files and the approval of first articles. By definition, the programming file must be released to a third party programming house. Nondisclosure Agreements (NDAs) can be signed to help ensure data protection; however, for extremely security conscious designs, this may not be an option.

- Actel In-House Programming (IHP)

  When purchasing Actel devices in volume, IHP can be requested as part of the purchase. If this option is chosen, there is a small cost adder for each device programmed. Each device is marked with a special mark to distinguish it from blank parts. Programming files for the design will be sent to Actel. Sample parts with the design programmed, First Articles, will be returned for customer approval. Once approval of First Articles has been received, Actel will proceed with programming the remainder of the order. To request Actel IHP, contact your local Actel representative.

- Distributor Programming Centers

  If purchases are made through a distributor, many of them will provide programming for their customers. Please consult with your preferred distributor about this option.

- Independent Programming Centers

  There are many programming centers that specialize only in programming but are not directly affiliated with Actel or our distributors. These programming centers must follow the guidelines for programming Actel devices and use certified programmers to program the Actel devices. Actel does not have recommendations for external programming centers.

Table 2 • **Volume Programming Services**

Programmer	Vendor	Availability
In-House Programming	Actel	Contact Actel Sales
Distributor Programming Centers	Memec Unique	Contact Distribution
Independent Programming Centers	Various	Contact Vendor

Programming Solutions

Details for the available programmers can be found in the programmer user's guides listed in the "Related Documents" section on page 12. Refer to Table 3 on page 6 for more information concerning programming solutions.

All of the programmers except the FlashPro3, FlashPro Lite, or FlashPro require adapter modules, which are designed to support device packages. The modules are all listed on the Actel website at http://www.actel.com/products/tools/silisculpt/modules.html.
They are not listed in this application note, since this list is updated frequently with new package options and any upgrades required to improve programming yield or support new families.

Table 3 • **Programming Solutions**

Programmer	Vendor	ISP	Single Device	Multi Device	Availability
FlashPro3	Actel	Only	Yes	Yes[1]	Available
FlashPro Lite	Actel	Only	Yes	Yes[1]	Available
FlashPro	Actel	Only	Yes	Yes[1]	Available
Silicon Sculptor II	Actel	Yes	Yes[2]	Cascade option (up to two)	Available
Silicon Sculptor	Actel	Yes	Yes	Cascade option (up to four)	Discontinued
Sculptor 6X	Actel	No	Yes	Yes	Discontinued
BP Micro Programmers	BP Microsystems	No	Yes	Yes	Contact BP Microsystems at http://www.bpmicro.com

Notes:

1. *Multiple devices can be connected in the same JTAG chain for programming.*
2. *Silicon Sculptor II can only provide ISP for ProASIC and ProASIC^{PLUS} families, not for ProASIC3/E.*

Programmer Ordering Codes

The products shown below can be ordered through Actel sales and will be shipped directly from Actel. Products can also be ordered from Actel distributors, but will still be shipped directly from Actel. Table 4 includes ordering codes for the full kit, as well as codes for replacement items and any related hardware. Some additional products can be purchased from external suppliers for use with the programmers. Ordering codes for adapter modules used with Silicon Sculptor are available on the Actel website at http://www.actel.com/products/tools/silisculpt/modules.html.

Table 4 • **Programming Ordering Codes**

Description	Vendor	Ordering Code	Comment
FlashPro3 isp programmer	Actel	FLASHPRO 3	Uses a 2x5, RA male header connector
FlashPro Lite ISP programmer	Actel	FLASHPRO LITE	Supports small programming header or large header through header converter (not included)
FlashPro ISP programmer	Actel	FLASH PRO	Supports small programming header or large header through header converter (not included)
Silicon Sculptor II	Actel	SILICON-SCULPTOR II	Requires add-on adapter modules to support devices
Silicon Sculptor ISP module	Actel	SMPA-ISP-ACTEL-2-KIT	Ships with both large and small header support
Concurrent programming cable	Actel	SS-EXPANDER	Used to cascade Silicon Sculptor I programmers together*
Software for Silicon Sculptor	Actel	SCULPTOR-SOFTWARE-CD	http://www.actel.com/custsup/updates/silisculpt/
ISP cable for small header	Actel	ISP-CABLE-S	Supplied with Silicon Sculptor II
ISP cable for large header	Actel	PA-ISP-CABLE	Supplied with Silicon Sculptor II
Header converter	Actel	Header-Converter	Converts from Small to Large Header
Small programming header	Samtec	FTSH-113-01-L-D-K	Supported by FlashPro, FlashPro Lite, and Silicon Sculptor In migrating to ProASIC3/E devices, an FP3-26PIN-ADAPTER is required.

Note: **A maximum of two Silicon Sculptor II programmers can be chained together using a standard IEEE-1284 parallel port cable.*

Table 4 • **Programming Ordering Codes (Continued)**

Description	Vendor	Ordering Code	Comment
10-pin 0.1" pitch cable header (right angle PCB mount angle)	AMP	103310-1	Supported by FlashPro3
10-pin 0.1" pitch cable header (straight PCB mount angle)	3M	2510-6002UB	Supported by FlashPro3
Compact programming header	Samtec	FTSH-105-01-L-D-K	Supported by FlashPro3, FP3-26PIN-ADAPTER required
Migration and compact header adapter	Actel	FP3-26PIN-ADAPTER	Required with the use of FTSH-105-01-L-D-K
Large programming header 0.062 in. board thickness	3M	3429-6502	Supported by Silicon Sculptor by default, FlashPro, and FlashPro Lite, with Header converter
Large programming header 0.094 in. to 0.125 in. board thickness	3M	3429-6503	Supported by Silicon Sculptor by default, FlashPro, and FlashPro Lite, with header converter
Plug in header small	Actel	SMPA-ISP-HEADER-S	Required for Small Header for ProASIC only, not used for ProASIC^{PLUS}
Plug in header	Actel	SMPA-ISP-HEADER	Required for Large Header for ProASIC only, not used for ProASIC^{PLUS}
Vacuum pens for PQ, TQ, VQ; < 208 pins	Actel	PENVAC	
Vacuum pens for PQ, TQ, VQ; ≥ 208 pins	Actel	PENVAC-HD	Heavy-duty, provides stronger vacuum

Note: **A maximum of two Silicon Sculptor II programmers can be chained together using a standard IEEE-1284 parallel port cable.*

Programmer Device Support

Refer to Table 5 to determine which general purpose Flash devices have programmer device support. To learn more about the different Actel families, refer to the Actel website: http://www.actel.com/products/devices.html.

Table 5 • **Programmer Device Support**

Actel Family	Device	Silicon Sculptor	Silicon Sculptor 6X	Silicon Sculptor II	FlashPro	FlashPro Lite	FlashPro3
ProASIC3	A3P030 A3P060 A3P125 A3P250 A3P400 A3P600 A3P1000	No	No	Yes. No ISP support.	No	No	Yes
ProASIC3E	A3PE600 A3PE1500 A3PE3000	No	No	Yes. No ISP support.	No	No	Yes
ProASIC PLUS	APA075 APA150 APA300 APA450 APA600 APA750 APA1000	Yes	Yes	Yes	Yes	Yes	No
ProASIC	A500K50 A500K130 A500K180 A500K270	Yes	Yes	Yes	Yes	No	No

Note: **Refer to the "Certified Programming Solutions" section on page 8 for more information on programmer support.*

Certified Programming Solutions

The Actel certified programmers for Flash devices are FlashPro3, FlashPro Lite, FlashPro, Silicon Sculptor I and II, and any programmer that is built by BP Microsystems. All other programmers are considered noncertified programmers.

- **FlashPro3, FlashPro Lite, FlashPro**

  The Actel family of FlashPro device programmers provides in-system programming (ISP) in an easy-to-use, compact system that supports all ProASIC families. Whether programming a board containing a single device or multiple devices connected in a chain, the Actel line of FlashPro programmers enables fast programming and reprogramming. Programming with the FlashPro series of programmers saves board space and money as it eliminates the need for sockets on the board. There are no built-in algorithms, so there is no delay between product release and programming support.

- **Silicon Sculptor II**

  Silicon Sculptor II is a robust, compact, single-device programmer with standalone software for the PC. It is designed to enable concurrent programming of multiple units from the same PC with speeds equivalent to or faster than previous Actel programmers. It replaces Silicon Sculptor I as the Actel programmer of choice.

- **Silicon Sculptor I and Silicon Sculptor 6X**

  Actel no longer offers the Silicon Sculptor I and Silicon Sculptor 6X for sale. Both items have been discontinued. Actel does support Silicon Sculptor I and Silicon Sculptor 6X by continuing to release new software that enables improved programming of previously covered Actel devices; new Actel devices are only supported on Silicon Sculptor II. All software support for Silicon Sculptor I and Silicon Sculptor 6X programmers will be disconnected by the end of 2005; no support for these older programmers will be offered in 2006. Actel recommends that all customers upgrade to a Silicon Sculptor II or a BP multi-site programmer.

- **Noncertified Programmers**

  Actel does not test programming solutions from other vendors, and CANNOT guarantee programming yield. Also, Actel will not perform any failure analysis on devices programmed by hardware from other vendors.

- **Programming Centers**

  Actel programming hardware policy also applies to programming centers. Actel expects all programming centers to use certified programmers to program Actel devices. If a programming center uses noncertified programmers to program Actel devices, then the "Noncertified Programmers" policy will apply.

Flash Programming Guidelines

Preprogramming Setup

Before programming, several steps are required to ensure an optimal programming yield.

Use Proper Handling and Electrostatic Discharge (ESD) Precautions

Actel FPGAs are sensitive electronic devices that are susceptible to damage from ESD and other types of mishandling. For more information about ESD, refer to the *Actel Quality and Reliability Guide* beginning on page 41.

Use the Latest Version of the Designer Software to Generate Your Programming File (Recommended)

The files used to program Actel Flash devices (*.bit, *.stp) contain important information about the switches that will be programmed in the FPGA. Find the latest version and corresponding release notes at http://www.actel.com/custsup/updates/designer/index.html. Also, programming files must always be zipped during file transfer to avoid the possibility of file corruption.

Use the Latest Version of the Programming Software

The programming software is frequently updated to accommodate yield enhancements in FPGA manufacturing. These updates ensure maximum programming yield and minimum programming times. Before programming, always check the version of software being used to ensure it is the most recent. Depending on the programming software, refer to one of the following:

- FlashPro: http://www.actel.com/custsup/updates/flashpro/index.html
- Silicon Sculptor: http://www.actel.com/custsup/updates/silisculpt/

Use the Most Recent Adapter Module with Silicon Sculptor

Occasionally, Actel makes modifications to the adapter modules to improve programming yields and programming times. To identify the latest version of each module before programming, visit http://www.actel.com/products/tools/silisculpt/modules.html.

Perform Routine Hardware Self-Diagnostic Test

- FlashPro

  The self-test is only applicable when programming with FlashPro and FlashPro3 programmer. It is not supported with FlashPro Lite. To run the self-diagnostic test, follow the instructions given on page 16 of http://www.actel.com/documents/flashproug.pdf.

- Silicon Sculptor

  The self-diagnostic test verifies correct operation of the pin drivers, power supply, CPU, memory, and adapter module. This test should be performed before every programming session. At minimum, the test must be executed every week. To perform self-diagnostic testing using the Silicon Sculptor software, perform the following steps, depending on the operating system:

  – DOS: From anywhere in the software, type **ALT-D**.

  – Windows: Click **Device** > select **Actel Diagnostic** > select the **Test** tab > click **OK**.

Programming Flash FPGAs

Programming a Flash device is a one-step process whether programming is conducted with a socket adapter module or via ISP. The Execute function will automatically erase the device, program the Flash cells, and verify that it is programmed correctly. Actel recommends confirming the security status is correct before programming.

The following steps are required to program Actel Flash FPGAs.

Programming with FlashPro

Setup

Properly connect the FlashPro ribbon cable with the programming header and turn on the switch. Actel recommends running the self-test before programming any devices; see the "Perform Routine Hardware Self-Diagnostic Test" section on page 10.

In the programming software, from the File menu, click **Connect**. In the FlashPro **Connect to Programmer** dialog box that appears, select the port to which the FlashPro programmer is connected, and select the device family. Disable voltages from the programmer if they are available on the board.

Click **Connect**. A successful connect or any errors appear in the Log window.

Analyze Chain and Device Selection

From the File menu, click **Analyze Chain**. Chain details appear in the Log window. If any failures appear, refer to the error and troubleshooting section of *FlashPro User's Guide*. Select the device to be programmed from the **Device** list. If only one device is present in the chain, performing Analyze Chain selects that device automatically from the Device list.

Loading the STAPL file

FlashPro3, FlashPro Lite, and FlashPro programmers use a STAPL (.stp) file to program the device. To load the STAPL file, from the File menu, click **Open STAPL** file or click the **Open File** button in the toolbar.

Selecting an Action

After loading the STAPL file, select an action from the Action list. See Table 1-1 in the *FlashPro User's Guide* for a definition of each action.

Programming the Device

To program the device, in the Action list, select **Program**. Make the required selections and click **Execute** to start programming. The progress of the programming action displays in the Log window. The message "Exit 0" indicates that the device has successfully been programmed.

Note: Do not interrupt the programming sequence, it may damage the device or programmer.

Verify the Correct Programming

To verify the device is programmed with the correct STAPL file, load the STAPL file and in the Action list, click **Verify**. Click **Execute** to start the verification process. A successful verification results in Exit 0.

Note: Verification is also performed in the previous "Programming the Device" step, hence clicking **Verify** is an additional standalone option.

Programming Failure Allowances

Flash FPGAs are reprogrammable, hence Actel tests the programmability for 100% of the devices shipped.

Return Material Authorization (RMA) Policies

Actel consistently strives to exceed customer expectations by continuing to improve the quality of our products and our quality management system. Actel has Return Material Authorization (RMA) procedures in place to address programming fallout. Customers should be mindful of the following RMA policies.

All devices, submitted for an RMA, must be within the Actel warranty period of one year from date of shipment. Actel will reject RMAs for devices that are no longer under warranty.

RMAs will only be authorized for current Actel devices. Devices that have been discontinued will not receive RMAs. All functional failure analysis requests must be initiated by opening a case with Actel Technical Support. Devices returned for failure analysis against an RMA should be in their original packaging and must have an RMA number issued by Actel.

Contacting the Customer Support Group

Highly skilled engineers staff the Customer Applications Center from 7:00 A.M. to 6:00 P.M., Pacific time, Monday through Friday. You can contact the center by one of the following methods.

Electronic Mail

You can communicate your technical questions to our e-mail address and receive answers back by e-mail, fax, or phone. Also, if you have design problems, you can e-mail your design files to receive assistance. Actel monitors the e-mail account throughout the day. When sending your request to us, please be sure to include your full name, company name, and contact information for efficient processing of your request. The technical support e-mail address is tech@actel.com.

Telephone

Our Technical Support Hotline answers all calls. The center retrieves information, such as your name, company name, telephone number, and question. Once this is done, a case number is assigned. Then the center forwards the information to a queue where the first available applications engineer receives the data and returns your call. The phone hours are from 7:00 A.M. to 6:00 P.M., Pacific time, Monday through Friday.

The Customer Applications Center number is (800) 262-1060.

European customers can call +44 (0) 1256 305 600.

Related Documents

Below is a list of related documents, their location on the Actel website, and a brief summary of each document.

FlashPro Programmers

FlashPro3

http://www.actel.com/products/tools/flashpro3/index.html

FlashPro Lite

http://www.actel.com/products/tools/flashprolite/index.html

FlashPro

http://www.actel.com/products/tools/flashpro/index.html

Refer to the FlashPro webpage for information on what is included when you purchase FlashPro.

FlashPro User's Guides

http://www.actel.com/documents/flashproug.pdf

The FlashPro User's Guide includes hardware and software setup, self-test instructions, use instructions, and troubleshooting/error message guide.

Silicon Sculptor II

http://www.actel.com/products/tools/silisculpt/index.html

The Silicon Sculptor web page includes a description of both Silicon Sculptor I and II.

Security in Actel Flash FPGAs

http://www.actel.com/products/rescenter/security/solutions/flash.aspx

The security resource center describes the security in Actel Flash FPGAs.

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